

CLAIMS

1. A mining light comprising:

a light module, the light module including

a semiconductor chip capable of emitting generally monochromatic light,

a wavelength shifting coating on said chip for converting generally monochromatic light emitted by said semiconductor chip to white light,

a primary heat sink to which said semiconductor chip is attached,

a secondary heat sink to which said primary heat sink is directly or indirectly attached, said primary heat sink and said secondary heat sink being in heat conductance with each other,

a dissipation heat sink having geographical features to aid in heat dissipation, said secondary heat sink being in heat conductance with said dissipation heat sink,

a heat conductance path originating at said semiconductor chip where heat is produced by said chip when it is powered and emitting light, said heat conductance path thence to said primary heat sink, thence to said secondary heat sink and thence to said dissipating heat sink,

said secondary heat sink having a greater internal volume than said primary heat sink,

a remote battery pack, said battery pack and said light module being physically separate for mounting in separate locations on a mining helmet,

said remote battery pack being in electrical communication with said light module so that said remote battery pack may provide electrical power for powering operation of the mining light.

2. A device as recited in claim 1 wherein said light module further comprises:

a magnetic switch that utilizes a magnetic field to initiate and terminate electrical connection of the light module to a battery pack, said magnetic switch being airtight.

3. A device as recited in claim 1 further comprising second remote battery pack.

4. A device as recited in claim 3 further comprising a strap for securing said battery packs on opposite sides of a mining helmet.

5. A device as recited in claim 1 further comprising light reflective adhesive between said semiconductor chip and said primary heat sink.

6. A device as recited in claim 1 further comprising heat conductive adhesive between said primary and said secondary heat sinks.

7. A device as recited in claim 1 further comprising a light reflector in said light module, said light reflector serving to gather light emitted by said semiconductor chip and reflecting it as a useful light beam.

8. A device as recited in claim 1 wherein said semiconductor chip is selected from the group consisting of light emitting diode chips, LED chip arrays, laser diodes, vertical cavity surface

emitting lasers, VCSEL arrays, edge emitting lasers, surface emitting lasers and photon recycling devices.

9. A device as recited in claim 1 wherein at least one of said heat sinks includes a material selected from the group consisting of copper, aluminum, silver, magnesium, steel, silicon carbide, boron nitride, tungsten, molybdenum, cobalt, chrome, Si, SiO₂, SiC, AlSi, AlSiC, and diamond.

10. A device as recited in claim 1 wherein said chip includes epitaxial layers located on a substrate and wherein said substrate is selected from the group consisting of Si, GaAs, GaN, ZnS, ZnSe, InP, Al₂O₃, SiC, GaSb, and InAs.

11. A device as recited in claim 1 wherein said semiconductor chip includes epitaxial layers located on a substrate.

12. A mining light comprising:

a light module, the light module including

a semiconductor chip capable of emitting generally monochromatic light,

a wavelength shifting coating for converting generally monochromatic light emitted by said semiconductor chip to white light,

a primary heat sink to which said semiconductor chip is attached,

a secondary heat sink to which said primary heat sink is directly or indirectly attached, said primary heat sink and said secondary heat sink being in heat conductance with each other, and

a magnetic switch that utilizes a magnetic field to initiate and terminate electrical connection of the light module to a battery pack in order to initiate and terminate light emission from the mining light, said magnetic switch being airtight, and

a remote battery pack, said battery pack and said light module being physically separate for mounting in separate locations on a mining helmet,

said remote battery pack being in electrical communication with said light module so that said remote battery pack may provide electrical power for powering operation of the mining light.

13. A device as recited in claim 12 further comprising second remote battery pack and a strap for securing said battery packs on opposite sides of a mining helmet.

14. A device as recited in claim 12 further comprising light reflective adhesive between said semiconductor chip and said primary heat sink.

15. A device as recited in claim 12 further comprising heat conductive adhesive between said primary and said secondary heat sinks.

16. A device as recited in claim 12 further comprising a dissipation heat sink and a heat conductance path going from said chip to said primary heat sink to said secondary heat sink and finally to said dissipation heat sink where heat created by said chip is dissipated.

17. A device as recited in claim 12 further comprising a light reflector in said light module, said light reflector serving to gather light emitted by said semiconductor chip and reflecting it as a useful light beam.

18. A device as recited in claim 12 wherein said semiconductor chip is selected from the group consisting of light emitting diode chips, LED chip arrays, laser diodes, vertical cavity surface emitting lasers, VCSEL arrays, edge emitting lasers, surface emitting lasers and photon recycling devices.
19. A device as recited in claim 12 wherein at least one of said heat sinks includes a material selected from the group consisting of copper, aluminum, silver, magnesium, steel, silicon carbide, boron nitride, tungsten, molybdenum, cobalt, chrome, Si, SiO₂, SiC, AlSi, AlSiC, and diamond.
20. A device as recited in claim 12 wherein said chip includes epitaxial layers located on a substrate and wherein said substrate is selected from the group consisting of Si, GaAs, GaN, ZnS, ZnSe, InP, Al₂O₃, SiC, GaSb, and InAs.
21. A device as recited in claim 12 wherein said semiconductor chip includes epitaxial layers located on a substrate.
22. A mining light comprising:
- a light module, the light module including
 - a semiconductor chip capable of emitting light when electrically powered,
 - a primary heat sink to which said semiconductor chip is attached,
 - a secondary heat sink to which said primary heat sink is directly or indirectly attached, said primary heat sink and said secondary heat sink being in heat conductance with each other, and

a magnetic switch that utilizes a magnetic field to initiate and terminate electrical connection of the light module to a battery pack, said magnetic switch being airtight, and

a battery pack, said battery pack being in electrical communication with said light module so that said remote battery pack may provide electrical power for powering operation of the mining light.

23. A mining light comprising:

a semiconductor chip capable of emitting light,

a heat sink for dissipating heat created by said chip, and

a magnetic switch that utilizes a magnetic field to initiate and terminate electrical connection of the light module to a battery in order to initiate and terminate light emission from the mining light, said magnetic switch being airtight.

24. A mining light comprising:

a semiconductor chip capable of emitting light,

a heat sink for dissipating heat created by said chip,

a reflector for gathering light emitted by said chip and reflecting it as a light beam, and

a magnetic switch that utilizes a magnetic field to initiate and terminate electrical connection of the light module to a battery in order to initiate and terminate light emission from the mining light, said magnetic switch being airtight.